## Chemistry of $NO_2$ and $SO_2$ on Ice: Photoemission Studies on the Formation of Acid Water

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**Introduction**: Low concentrations of ozone have been systematically observed in Antarctic areas for the last few decades. Ozone depletion has been considered a result of heterogeneous catalytic reactions on polar stratospheric clouds (PSCs) and photochemical reactions. An understanding of the chemistry of PSCs or ice surfaces as models could greatly help to explain the phenomena of the ozone holes. Nitric and sulfur dioxides ($NO_2$ and $SO_2$) are one of the most dangerous atmospheric pollutants. When released into the air, $NO_2$ and $SO_2$ undergo oxidation processes and react with water to form acid particles or droplets.

**Methods and Materials**: Synchrotron-based high-resolution photoemission (PE) was used to study the interaction of $NO_2$ and $SO_2$ with ice surfaces.

**Results**: On ice films, $SO_2$ is more reactive than $NO_2$ [1]. Small amounts of dosed $SO_2$ react with surfaces of ice at 100 K producing sulfuric acid-like species ($H_xSO_4$). Extensive dosing leads to a condensed $SO_2$ multilayer that is thermally unstable and desorbs from the ice substrate upon mild heating to 130-150 K. The acid water produced in this way was able to corrode metals like zinc or iron [1]. At 100 K, the initial stage of $NO_2$ adsorption on ice is nonreactive. The formation of a weakly bonded {ONO···$NO_2$} dimers takes place. $NO_2$ reacts with ice only at high exposures producing a small amount of nitric acid-like species ($H_yNO_3$) [1]; followed by condensation of an $O_2N$-$NO_2$ multilayer. The $N_2O_4$ multilayer partially desorbs at temperatures around 150 K and partially reacts with ice producing more $H_yNO_3$.

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**References**:

1. T. Jirsak and J.A. Rodriguez Langmuir, in press.